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THE

NATIONAL GEOGRAPHIC MAGAZINE

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The list of contributors to the NATIONAL GEOGRAPHIC MAGAZINE includes nearly every United States citizen whose name has become identified with Arctic exploration, the Bering Sea controversy, the Alaska and Venezuela boundary disputes, or the new commercial and political questions arising from the acquisition of the Philippines.

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"Russia," by Professor Edwin A. Grosvenor of Amherst College, Massachusetts.

"The Venezuelan Boundary," by Mr Marcus Baker of the Venezuelan Commission.

"The Samoan Islands," by Mr Edwin Morgan, Secretary of the Samoan Commission.

"The Native Tribes of Patagonia," by Mr J. B. Hatcher of Princeton University.

"The Characteristics of the Filipinos," by Hon. Dean C. Worcester of the Philippine Commission.

"Discoveries in the Fossil Fields of Wyoming in 1899," by Prof. Wilbur C. Knight of the University of Wyoming.

"Explorations on the Yangtse-Kiang, China," by Mr Wm. Barclay Parsons, C. E., surveyor of the railway route through the Yangtse-Kiang Valley.

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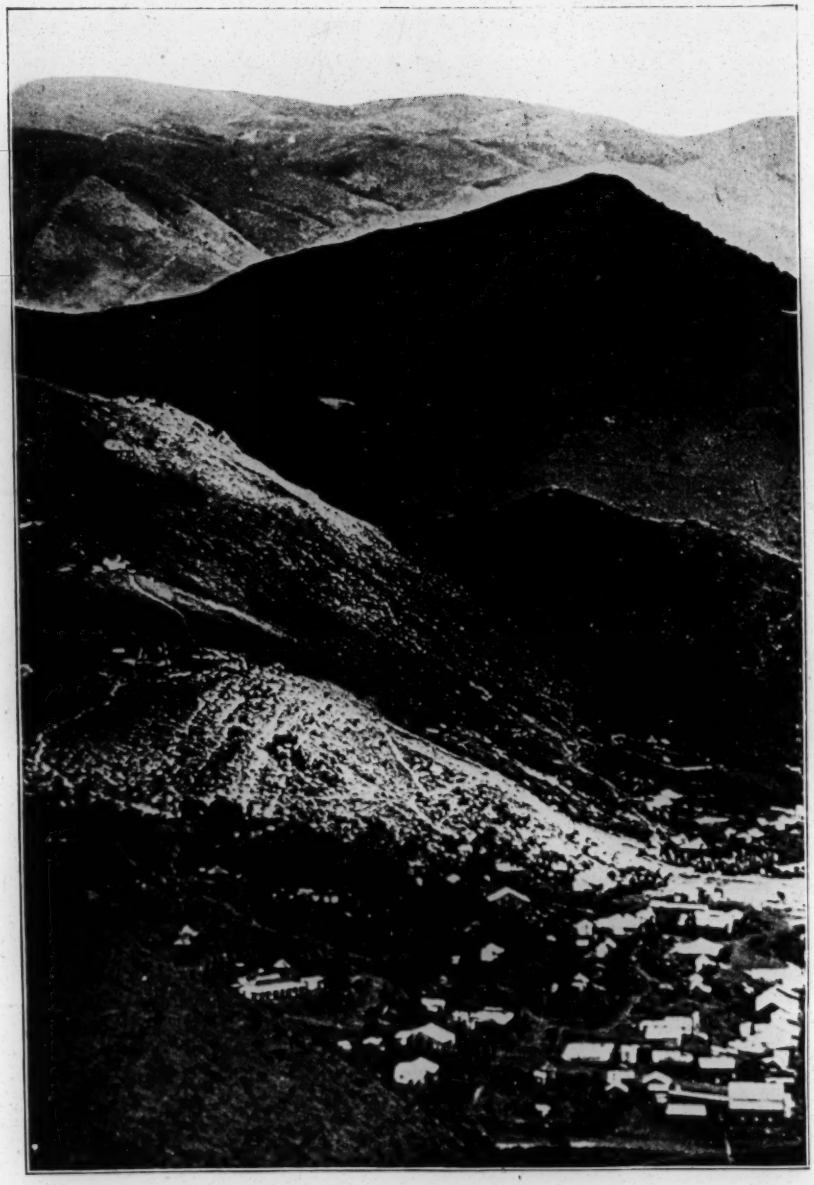


IN THE DRAKENBURG RANGE

THE

NATIONAL GEOGRAPHIC MAGAZINE

VOL. XI MARCH, 1900 No. 3

BRITISH SOUTH AFRICA AND THE TRANSVAAL

By F. F. HILDER,

Bureau of American Ethnology

To one approaching the coast of South Africa in the neighborhood of Table Bay from the west, the first object which strikes the eye is the great mass of Table Mountain looming up above the lower foothills of the coast. Passing Robben Island, the ship enters Table Bay, a magnificent harbor, protected by nature from all but northwest winds. A splendid system of breakwater and docks now affords safety to shipping at all seasons.

Round the base of the mountain lie the suburbs Rondebosch, Claremont, Wynberg, and Constantia, which are surrounded with luxuriant vegetation, including oaks, firs, shrubs of many kinds, flowers, and vineyards which produce excellent wine. Cape Town lies between the foot of Table Mountain and the bay; it is the capital of the colony, the residence of the governor, and the seat of the legislature. The population, numbering about 70,000, is composed of many races, those of Dutch and English descent being most numerous; but there are also Americans and representatives of nearly every country in Europe. The laboring population comprises the descendants of negro slaves, Hottentots, Kafirs, and Malays.

The Cape of Good Hope from the time of its discovery by Bartholomeu Dias, the Portuguese navigator, in 1486, until 1652 was a place of call for ships of all nations. In that year the Dutch East India Company sent Jan Van Riebeck with a small force and a party of colonists to form a settlement there and hold it as a Dutch colony. The home authority, however, was not the government of Holland, but the directors of the Dutch East India Company at Amsterdam. The Dutch found the country inhabited by a native tribe who called

themselves Khoikhoin (men of men), but had been named Hottentots by the Portuguese, and Caepmans by the early Dutch settlers. The Dutch had difficulty in subduing these natives or making them labor, so that in 1658 they determined to institute negro slavery, and imported the first cargo of slaves from the Guinea Coast.

In 1687 the Dutch colonists were joined by a number of Huguenots, refugees who fled from France during the reign of Louis XIV, after the revocation of the Edict of Nantes, large numbers of whom sought an asylum in Holland and her colonies. For more than a century these colonists pursued a quiet existence as agriculturists and traders, disturbed only by occasional strife with the natives, until 1794, when Holland was overrun by the troops of the French Republic. To prevent the colony from falling into the hands of the French, it was captured by the English in 1795, but was restored to Holland in 1802 by the treaty of Amiens. As this peace proved to be illusory, war was renewed the following year, and Cape Colony was again captured by the English in 1806 and has since been in their possession.

In 1814, after the abdication of Napoleon, it was ceded to England by the treaty of Paris, which action was confirmed by the Congress of Vienna in 1815, and England paid to Holland a large sum of money as indemnity for the cession of Cape Colony and the territory in South America now known as British Guiana.

Leaving Table Bay and steaming eastward along the coast, mountains are in sight nearly all the way. To reach the interior of South Africa from any of the landing places on the east coast, a short extent of lowland must be crossed and steep mountains ascended to the level of the great plateau beyond. The east coast presents a fringe of subtropical country, where the magnolia and rose bloom and the orange, pineapple, lemon, grape, banana, cotton, and tea-plant flourish. As the elevation increases come the mountain ranges, in the valleys of which are growing crops of wheat and corn. Finally the high veldt is reached. This consists of vast level plains sparsely covered with short grass, dotted here and there by the karoo bush, a stunted shrub from a foot to eighteen inches in height, which gives pasturage to thousands of sheep and cattle.

There are four lines of railroad by which the South African Republic can be reached from the sea. The first extends from Cape Town and Port Elizabeth, with a branch from East London, to Johannesburg, and thence to Pretoria, traversing the Orange Free State from south to north. The second line lies more to the west and is wholly

in English territory. It starts from Cape Town, passes through Cape Colony, and follows closely the western frontier of the Orange Free State and the Transvaal. It passes through Kimberley and Mafeking, from whence a wagon road runs to Krugersdorp and Johannesburg. This road runs as far north as Bulawayo, about 1,300 miles north of Cape Town. The third road starts from Durban, in the colony of Natal, passes through Pietermaritzburg, the capital of the colony, and reaches Ladysmith, where it separates into two sections, one section extending westward into the Orange Free State and the other northward to Heidelberg and Johannesburg, in the Transvaal. This road enters the Transvaal territory through a tunnel under Laings Nek, a pass in the Drakensberg Mountains near Majuba Hill, where the English met such a crushing defeat in 1881.

The fourth line starts from Lourenço Marques on Delagoa Bay, traverses the Portuguese territory, enters the Transvaal at Komatipoort, and terminates at Pretoria. This is the only road by which the Transvaal government has been able to obtain supplies since the outbreak of the war.

The South African Republic was until a few years ago little known to the outside world. It was merely a pastoral and agricultural region, and such notoriety as it had achieved was due principally to the frequent wars and bloody contests between its Boer inhabitants and the British local and imperial authorities and the native tribes. Twenty years ago it was seldom visited except by traders and hunters in quest of big game, but the discovery of the marvelous gold deposits of the Witwatersrand in 1885 brought a rush of adventurers in search of wealth. It is true that gold had been discovered in the Lydenburg district as early as 1867, but not in sufficient quantities to attract great attention. Immediately a multitude of French, Portuguese, Germans, English, and Americans streamed into the country and the city of Johannesburg sprang up, like Aladdin's palace, in a day.

The Transvaal lies immediately north of her sister Boer republic, the Orange Free State, between the Limpopo or Crocodile River on the north and the Vaal River on the south. The country on the north and west is British. The republic has no seaport, as the Portuguese possessions and the colony of Natal shut it off from the Indian Ocean on the east. The Vaal River is the chief tributary of the great Orange River, which rises in the Drakensberg and flows across the continent into the Atlantic. The Limpopo empties into the Indian Ocean. The gold-bearing region, the Witwatersrand, or "White Water Range," forms the watershed between the two rivers.

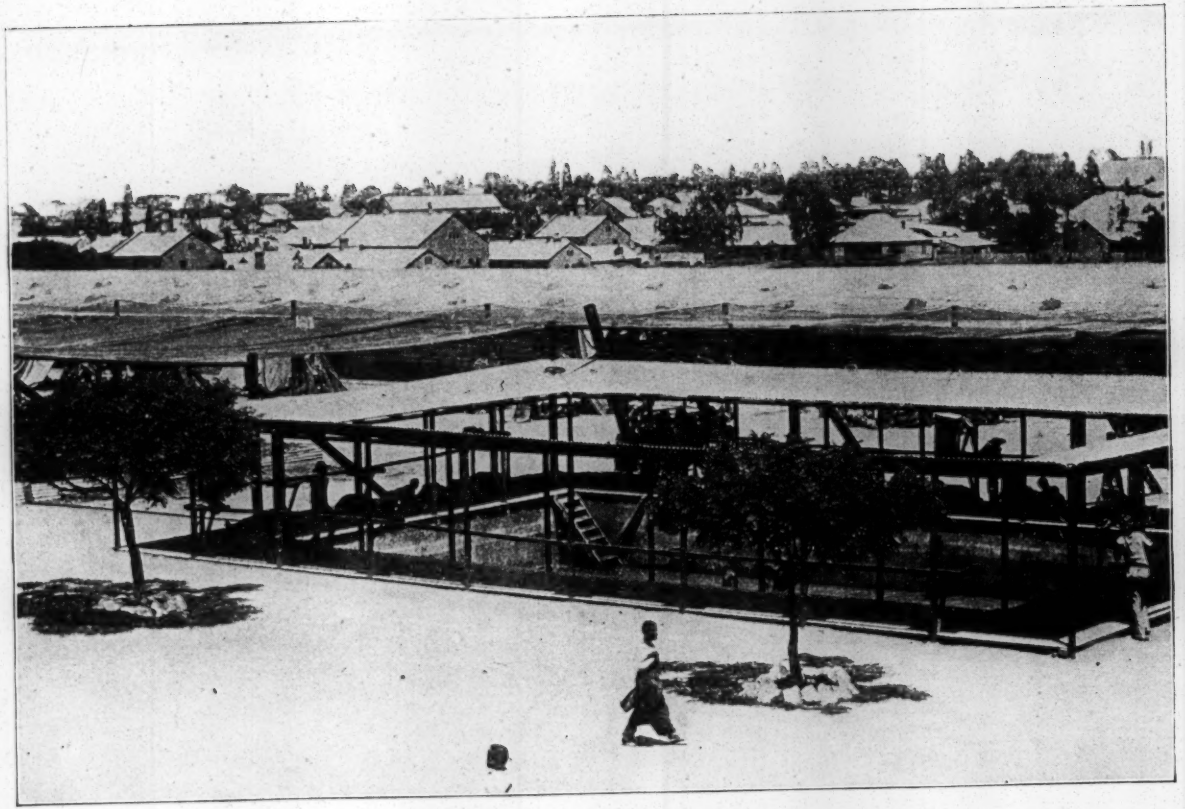
The Transvaal is a lofty plateau lying within the outer rim of the vast South African table-land, between 4,000 and 6,000 feet above the sea-level. In consequence of this great elevation, although it is intercepted by the tropic of Capricorn at a point between 60 and 70 miles to the south of its northern frontier, it enjoys a healthful and invigorating climate, except in some of the low-lying country on the Limpopo and other fluvial tracts near the eastern frontier. The winter half of the year, from March to September, is dry and cool, especially during the nights, but the days are often as warm as in summer. During these months cold, sharp winds blow from the south, and the mountain ranges are often covered for several days with snow, and hail storms are frequent.

In addition to its treasures of gold, the country is rich in other minerals, particularly iron. The Yzerberg, near Marabastad, is almost a solid mass of iron ore of the richest quality; coal of excellent quality is abundant, and supplies the mining industry with good and cheap fuel; copper, lead, quicksilver, etc., have also been found. The formations containing diamonds have also been found to extend into both the Orange Free State and the Transvaal.

Kimberley, the headquarters of the diamond industry, is in British territory, only four miles from the boundary of the Orange Free State and 647 miles from Cape Town. There are no natural features that can assist in its defense, but the great mounds of earth and debris from the mines have been utilized by the garrison for that purpose.

The dry diggings in the mines of the Kimberley district afford the only locality in which the diamond has thus far been found in its original home, and all our knowledge of the genesis of the diamond has been derived from the study of the conditions there existing. The mines are located in "pans" or depressions in which the blue ground is found that is now recognized as the matrix of the diamond. These pans formed the vents of ancient volcanoes which have been worn down by the forces of the atmosphere, and are the pipes or tubes through which the lava reached the surface; they are partly surrounded by black shale containing a large percentage of carbon, from which material the diamonds have been formed by crystallization.

As a proof of the wonderful progress which has been made in a place which only a few years back was a bare prairie, I will mention that a school of mines has lately been erected and opened at Kimberley. The courses of instruction are intended to prepare students for a diploma of mining engineer or for the degree of Bachelor of Science and Master of Science in mining engineering.



KIMBERLEY

BLOEMFONTEIN

The South African Republic has an area of 119,139 square miles, and in 1898 the population was estimated to be 1,094,156, of which 345,397 were whites and 748,759 colored natives. The white population, however, had been largely increased by the rush to the gold fields, and the number of Boers included in the enumeration of white inhabitants is probably less than 100,000.

In the whole of South Africa, in the same year, the white inhabitants, excluding the Dutch, numbered 385,500; of Dutch descent there were 431,000, making a total of 816,500 whites, while the native races numbered fully 15,000,000; so that there were about eighteen natives to every white inhabitant.

This sketch of the physical character and resources of the Transvaal is the stage setting of the theater, where a mighty human drama is now being enacted. A just estimate of the actors cannot be formed without considering the influences which have made the Boers what they are, nor can any conclusion be reached as to the future, not only of the Transvaal, but of the whole of South Africa, without considering the character and condition of the native population, a factor in the problem which has been seldom touched upon by writers of political and military essays on South African affairs.

The Boers are the descendants of the original Dutch and Huguenot colonists. Severed from the civilization of Europe two hundred years ago, they have not kept pace with the progress that has been made there and are intolerant and backward in their ideas, but they have developed into a sturdy, self-reliant people, well fitted to cope with the savage animals and savage men with whom they have had to contend in their colonization of the wilderness. They have been for the most part stock-raisers; the thinness of the pasture has caused them to scatter over a wide area, and they have thus led a solitary and somewhat nomadic life. Like all frontiersmen, they have developed remarkable courage and an indomitable spirit of independence; they have also become imbued with a passion for solitude and isolation, out of which has grown not only their impatience of control, but a certain degree of neglect of the graces, amenities, and even the decencies of civilized life, showing few traces of their descent from the cleanest and neatest people of Europe. Living in the open air, and mostly in the saddle, they are strangely ignorant. They have no literature and very few newspapers. Their reading is confined almost entirely to the Bible. Their religion is the somber and stern Calvinism of the seventeenth century, hostile to all new light, thoroughly imbued with

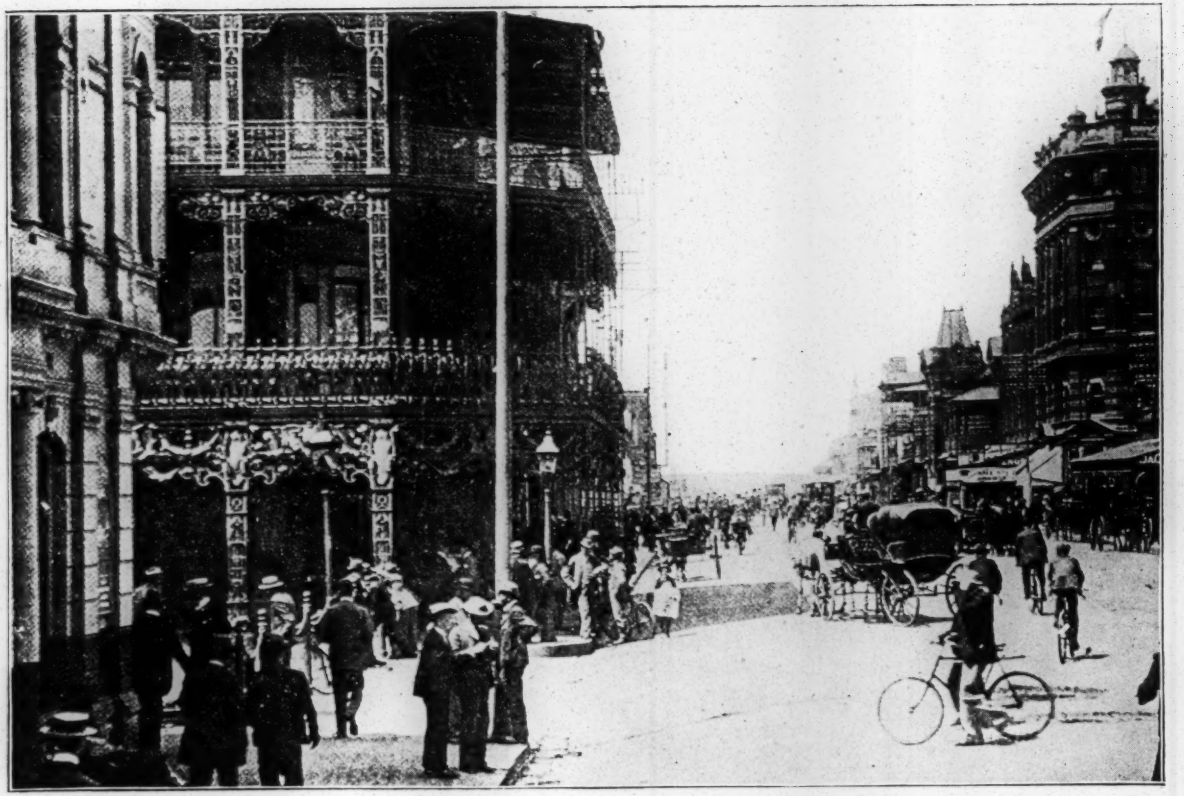
the spirit of the Hebrew records of the Old Testament, and with but little of the Christian spirit of kindness and mercy taught in the New.

In this characterization of the Boers I do not include the Burghers or more civilized Afrikanders of the cities, many of whom are as cultivated, well educated, and charming people as can be found in any part of the world.

The Boer skill with the rifle is due to long practice; with them hunting has been a matter both of dollars and cents and of self-protection. When they migrated from Cape Colony to the Transvaal they were compelled to clear the way by killing thousands of lions. Their creditable work of freeing the Transvaal from wild animals, that rendered life unsafe in the country, has been offset by their destruction of the giraffe, which has been almost exterminated by them from Cape Colony to their northern frontier. In the early days of South African history they were the most abundant wild animals in the Transvaal, Matabeleland, and the Orange Free State, but they have been exterminated like the American buffalo, and the few remaining representatives of the species have been gradually driven north. Like the buffalo, they were hunted because the skins had a commercial value, and even the bones and sinews were also turned to profitable account. In British territory they are now protected by law, but it is almost too late to save them from extinction.

For many years the Dutch and English lived together in amity, but in 1834 a law was passed in England abolishing negro slavery in all its colonies, much to the disgust of the Dutch, who held the old biblical notions on the subject of slavery. They fiercely resented what they believed to be an outrage on their property rights. It is true that the British government paid a compensation, but the amount being less than the current value of slaves in the colony, the Boer farmers considered that they had been robbed, and when the law was put in operation in 1835 they determined to leave the colony, and made what is still referred to among them as the "Great Trek."

They settled in what is now known as the colony of Natal, where they attempted to establish an independent government, a proceeding which was objected to by the British government on the ground that people who were still considered to be British subjects had no right to attempt to form an independent state in territory which, while it had not been formally declared to be a colony, was classed as a British protectorate. It was therefore formally proclaimed to be a British colony, and the Boers again migrated. Some settled in the Orange



PRETORIA — THE CLUB

CROSSING THE UMBELOSI RIVER, SWAZILAND

River country, and others crossing the Vaal River founded the South African Republic. The history of the troubles that have arisen between the Boers and the native tribes on the one hand, and the Boers and the British government on the other is too long and complicated for treatment in this paper, while the controversy which has unhappily terminated in the present war has been so thoroughly discussed in magazines and newspapers all over the world that I consider comment on that subject unnecessary. There have been faults on both sides, but so far as the British government is concerned the main cause of trouble has arisen from its vacillation and the want of a settled policy and course of action. With all the blessings of a government by popular representation, it has its weaknesses, and this is not the least of them. To this cause may be traced in great measure the uncertain and unstable policy which, so far as Great Britain is concerned, forms the head and front of her offending in South Africa.

Whichever way the present contest may terminate, it must lead to a better condition than that which has existed for many years past. If by any combination of circumstances the Boer Republics should be successful and the whole of South Africa were to be united under Dutch-Afrikander rule, even that would be better than the continual atmosphere of strife and unrest that has prevailed. It appears, however, hardly possible that the power of England when fully put forth can be successfully resisted by the Boers. Then the logical result would be the formation of a Dominion of South Africa, something on the plan of the Canadian confederation, in which men of all races could enjoy the benefits of a strong, united government, and all classes and nationalities would be equal before the law. With universal suffrage and self-government, confidence would be restored, capital would flow into the country, railroads and public improvements would be constructed, and the boundless resources of the country would be still further developed and utilized.

South Africa has the advantage of being a country where the white man can live and thrive as well as in Australia, New Zealand, or Canada. When the passions which have been aroused by the struggle have subsided, there is little doubt that not only the Dutch, but all other elements of the population will recognize the benefits of peace and progress and become peaceful citizens of a free state.

When peace shall be restored, the great question that will arise will be the relation of the white man to the native races; but before entering upon that phase of the subject I will briefly describe the people

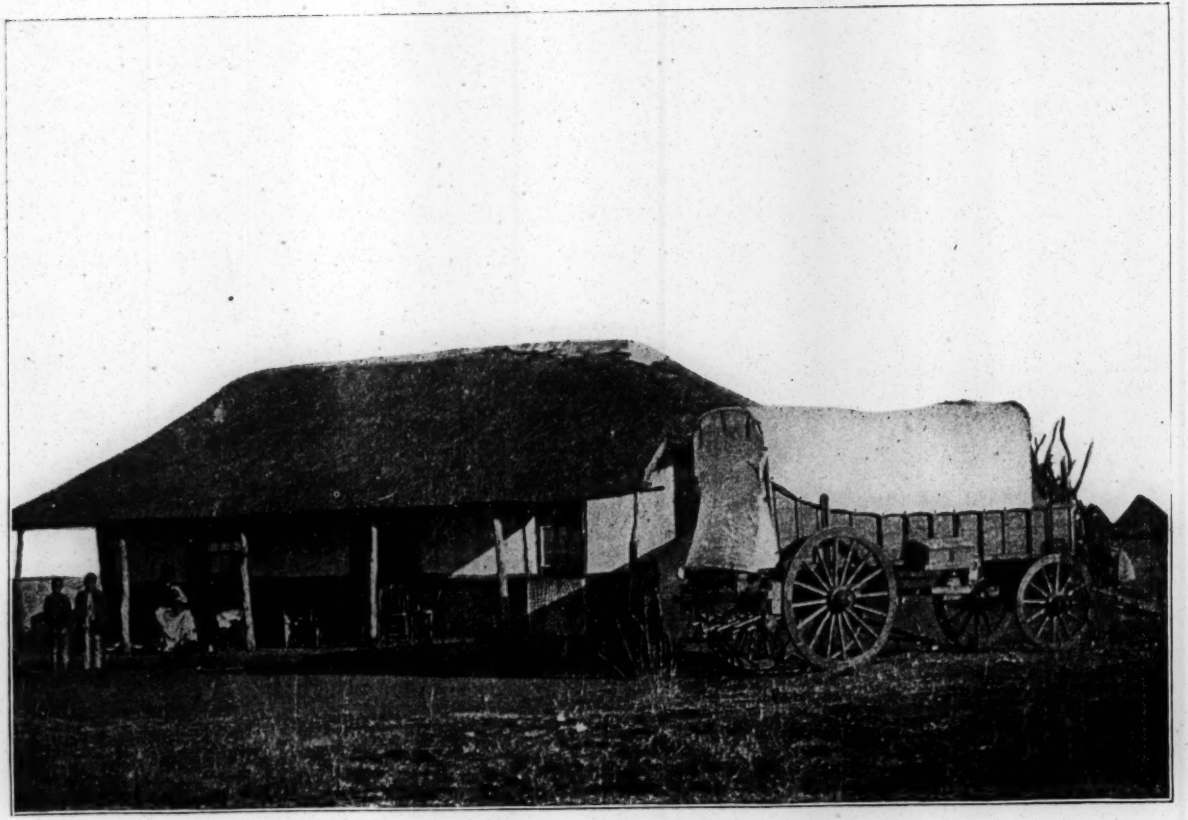
with whom the white man has to deal. When the Dutch settlement was first formed at the Cape, southern and southwestern Africa was occupied by Hottentots and Bushmen. The latter were the aboriginal inhabitants of the country, but had been driven into the less fertile and desert regions of the southwest by the Hottentots, who were in turn being pressed from the north and east by the Bantu tribes.

The Bushmen are a race of pygmies, seldom much over four feet in height. They are brown in color, with tufted wool on the scalp, sparkling eyes, high cheek-bones, and small feet and hands. They are of the same race as those met with by Stanley on his Central African journey, and there is no doubt that they belong to the same race as the pygmies described by Herodotus, the Greek historian, as being "found beyond the Libyan deserts." The Bushmen can be classed with the Australian aborigines as the lowest race in the human scale, even the negritos of the Philippine Islands being of a slightly higher grade.

The Hottentots are of larger stature than the Bushmen, brown in color, with faces thinner than those of the Bantu tribes, high cheek-bones, and projecting lips, with tufted, wooly hair. Many of them in Cape Colony are the descendants of slaves, and the race there has been so long associated with the Dutch farmers that their language has practically died out, and most of them have adopted European dress.

The most important race of South Africa, however, is the Bantu, which is the generic name given to all the Kafir and Zulu tribes of South and Central Africa. These Bantu tribes are believed to be the result of an intermingling of a Libyan or Arab race with the typical negroes of western Africa. In them the nose is more prominent and the cast of the face higher than in the pure negro. The principal divisions of this people in the country treated of in this paper are the Kafirs, Zulus, Swazis, Basutos, and Matabeles; but as the Kafirs are the people most in evidence in Natal, the Boer Republics, and eastern South Africa, I will discuss them chiefly.

The name Kafir is of Persian origin, and is that applied by Mohammedans to all who reject the faith of Islam. It was in use along the coast of the Indian Ocean when the Portuguese explorers arrived on the east coast of Africa, and has passed from them to the English and Dutch, among whom the word Kafir is generally used to signify any colored native who is not the descendant of an imported negro slave. They are really the people of the Amacosa tribe of the great Bantu nation. Most of these tribes derive their names from that of their



TYPICAL BOER HOUSE AND TENT-WAGON

KAFIR MATRONS

first great chief and founder. The prefix "Ama" signifies "those of," *i. e.*, Amacosa, "those of Cosa." It is a curious fact that, although Europeans have given them the name of Kafirs, they themselves cannot pronounce the word, as the English sound of *r* is wanting in their language. In fact, they have no word to signify the whole race, and each tribe is known by its particular title. The women do not always use the same language as the men, owing to the custom which prohibits females from pronouncing the names of their husband's male relations or any words in the principal syllables of which such names occur. In this manner almost a distinct dialect has come into use among them.

As before the advent of white men the Kafirs knew nothing of letters or signs by which ideas can be expressed, their history is entirely traditional and at most does not reach back more than three or four generations.

Ornaments of shells, teeth, and beads strung on strips of skin are worn in the hair and on the body by both sexes, and copper and other rings on the arms and ankles. They protect their bodies from the effect of the sun by rubbing themselves with fat and red clay, which makes them look like polished bronze. This is necessary, as their clothing is infinitesimal in quantity; in warm weather men and children go entirely nude; in cold weather they use a square mantle of skins of animals, called "kaross," which they wrap round them as our Indians use their blankets. For the chiefs the skin of the leopard is reserved, but the skins of all other animals are used by the people. In consequence of the influx of Europeans and European manufactures, these skin mantles are largely replaced by blankets. Women wear a small leather apron at all times. Since the advent of white men clothing has been introduced among them, but they still show a propensity to get rid of as much of it as possible during warm weather.

Horned cattle constitute the wealth of the Kafir, and tending them and fighting he considers to be the only occupation fit for a man. The women do all the heavy work, not only the cooking, carrying water, etc., but the labor of raising such crops as they cultivate.

When the first railroad was built through their country they were filled with awe at the sight of a locomotive. As they had no conception of locomotive power other than that of oxen, they concluded that some of them must be shut up inside the machine; hence when the engine stopped they gathered in curious crowds waiting to see the

door open and the oxen come out. They also thought it an act of cruelty to make so small an engine draw such a huge train of cars.

The conditions I have described, however, are rapidly changing before the march of civilization. But beyond the present outlook there is a cloud on the horizon, very small now, but which may at no distant day increase until it overshadows South Africa and sweeps it with the destructive force of a tornado. There has existed for some time in South Africa an uneasy consciousness of danger, from the fact that many of the natives are restless and dissatisfied to a considerable extent. When it is considered that they so enormously outnumber the white inhabitants, this is no imaginary danger. The Kafirs, Zulus, Basutos, Swazis, Matabeles, and other tribes of the Bantu race are not now as a whole untutored savages or weaklings, but a brave, virile race. Many of them, particularly among the Kafirs and Basutos, are well on the road to civilization, professing the Christian religion, having school-houses and churches; many of them also are tolerably well educated, speaking both Dutch and English, and are no longer willing to quietly endure the lordly superiority claimed by the white man over dark-skinned races; they have begun to realize their grievances and to long for the rights of free men. The Boers have always been harsh and tyrannical in their treatment of the natives, a survival, perhaps, of the consequence of their long connection with negro slavery and the struggles they have had, first with the Hottentots, and later with the Kafirs and other Bantu tribes. The English have treated the natives with greater humanity and justice than the Dutch have done, and the government regulations for their management are excellent, but the danger is that private cupidity and the struggle for wealth may induce the white man to override or evade these regulations.

The supreme question in the development of Africa is not the increase of the power and prestige of England, Germany, France, or any other European nation. All the nations that have been reconstructing the map of Africa must recognize the great responsibility they have incurred toward the native races. After the present war-clouds shall have been dissipated the future of South Africa will rest largely on the question of equity and integrity in the treatment of the natives. If those principles are strictly observed, there will lie a bright prospect before the country and its people, both white and colored; but if the white man closes his eyes and does not recognize the handwriting on the wall, he may receive a very rude awakening.

THE HISTORY AND GEOGRAPHIC DISTRIBUTION OF BUBONIC PLAGUE

By GEORGE M. STERNBERG, LL. D.,
Surgeon-General, U. S. Army

Although bubonic plague has never prevailed within the limits of the United States, its recent appearance in our island possessions in the Pacific has aroused great interest in the disease and considerable apprehension as to its epidemic extension in the future. It has effected a lodgment in Portugal and in Brazil during the past year, and at least one vessel has arrived at the port of New York with cases of the disease on board from the last-mentioned country. The question is therefore a very practical one as to whether there is any real danger of the introduction and extension of this pestilential malady of eastern countries in our own territory.

In view of the interest attached to this question, I have been invited to prepare a paper for the NATIONAL GEOGRAPHIC MAGAZINE upon the history and geographic distribution of the bubonic plague, and after considerable hesitation I have consented to do so. My hesitation was due to the fact that I fear it will be difficult for me to present the subject in a popular manner, and the historical details relating to the ravages of this pestilential disease in the past may prove fatiguing to some and repulsive to others. However, while I shall have to present a dark picture with reference to the past history of the disease, and some disagreeable facts as to its recent extension from its endemic foci in the Far East, I shall have the satisfaction of stating that preventive medicine has made such progress during the past fifty years that there is very little danger that bubonic plague will ever again commit serious ravages in the more enlightened countries of Europe, or that it is a serious menace to the lives and prosperity of citizens of the United States.

The history of bubonic plague extends back to a remote antiquity. Greek physicians of the second and third centuries before the Christian era have left a record of a pestilential malady characterized by the formation of buboes, which prevailed in Libya, in Egypt, and in Syria, and two Alexandrian physicians, Dioscorides and Poseidonios, who were cotemporaries of Christ, have given a description of the disease

which leaves no doubt as to its identity with the plague of more recent times. It may be well to explain at this point that the buboes characteristic of the disease are enlarged and inflamed glands in the groins, in the armpits, and elsewhere, which in chronic cases may suppurate and discharge a virulent pus, by which the disease is propagated. We now know that the germ of the disease is found not only in these suppurating buboes, but also in the blood of an infected individual.

Three forms of the disease are recognized by modern authors. A mild or abortive form, in which there is little pain or fever, and in which the buboes rarely suppurate. In this form the enlarged glands in the groin, armpit, and neck usually disappear in about two weeks. In its usual form the disease is ushered in with chilly sensations, fever, lassitude, and pain in the back and limbs. The buboes are quickly developed and the general symptoms soon assume a grave character. If the patient lives for a week or more the buboes usually suppurate and carbuncles and boils are often developed. In the third or fulminant form of the disease death may occur within a few hours from the outset of the attack and in advance of the development of the characteristic buboes. These cases could scarcely be recognized were it not for the fact that they occur during the epidemic prevalence of the disease among persons who have been exposed to infection.

From the first to the sixth centuries of the Christian era we have no authentic accounts of the prevalence of bubonic plague, but there is no reason to believe that it had entirely disappeared from those countries in which it had previously prevailed. During the sixth century, however, its ravages were greatly extended, and it prevailed as a devastating epidemic in many parts of the Roman Empire, both of the East and of the West. Indeed, in the time of Justinian it extended far beyond the limits of the Roman Empire. The origin of this extensive epidemic, which raged for more than half a century, appears to have been in lower Egypt in the year 542; thence it extended in one direction along the north coast of Africa and in the other into Palestine and Syria. The following year it invaded Europe, which at the time was in a state of political disturbance and warfare, and during this and subsequent years devastated many sections of the country, depopulating towns and leaving the country in some instances nothing more than a desert inhabited by wild beasts. The accounts given of this widespread epidemic indicate that other infectious maladies, which at that time had not been clearly recognized as

specific diseases, were associated with the plague and contributed to the general mortality.

During the middle ages epidemics continued to occur, but the accounts of the nature of the prevailing "pest" are usually confused and unsatisfactory, and it was not until nearly the middle of the fourteenth century that the horrible epidemic known as the "black death" devastated Europe and caused the death of more than 25,000,000 of its inhabitants. There has been considerable difference of opinion among the best authorities as to whether the "black death" of the fourteenth century was identical with bubonic plague. It presented some features which seem to distinguish it from subsequent epidemics, and it had its origin from a different quarter of the globe. While bubonic plague has usually invaded Europe from Egypt, the "black death" is believed to have originated in Northern China. It is not known exactly when or where this epidemic had its origin, but it is known to have reached the Crimea in 1346 and Constantinople the following year. The same year it was conveyed by ships to several seaports of Italy, both on the Mediterranean and the Adriatic, and also to Marseilles, on the French coast. In 1348 it extended to the interior of these countries and to Spain; also to England, Holland, and the Scandinavian Peninsula. The following year it completed the invasion of Europe.

The disease first appeared in London in November, 1348, and it continued to prevail in various parts of England for a period of eight or nine years. In 1352 the epidemic prevailed in the city of Oxford to such an extent that this city lost two-thirds of its academical population. The plague again invaded England in 1361 and 1368. As a result of these devastating epidemics in England, as well as in other parts of Europe, large parts of the country remained for a time uncultivated, and owing to the lack of laborers there was a great increase in wages.

The following graphic account of the ravages of this pestilence is by a writer of the period:

"Wild places were sought for shelter; some went into ships and anchored themselves afar off on the waters, but the angel that was pouring the vial had a foot on the sea as well as on the dry land. No place was so wild that the plague did not visit, none so secret that the quick-sighted pestilence did not discover, none could fly that it did not overtake. For a time all commerce was in coffins and shrouds, but even that ended. Shrift there was none; churches and chapels were open, but neither priests nor penitents entered—all went to the charnel-house. The sexton and the physician were cast into the same deep

and wide grave; the testator and his heirs and executors were hurled from the same cart into the same hole together. Fire became extinguished, as if its element had expired, and the seams of the sailorless ships yawned to the sun. Though doors were open and coffers unwatched, there was no theft; all offenses ceased, and no cry but the universal woe of the pestilence was heard among men."

That the "black death" of the fourteenth century was in fact the same disease which subsequently prevailed in Europe under the name of "the plague," and more recently known as "bubonic plague," can scarcely be doubted. But the epidemic was characterized by an unusually large number of cases of the pulmonary form of the disease, in which it seems probable that the lungs are the primary seat of infection, while in the bubonic form the bacillus effects a lodgment through some superficial wound or abrasion or possibly through the bites of insects, and first invades the lymphatics, producing inflammation of the nearest lymphatic glands. General invasion of the blood appears, from recent investigations, to be a secondary phenomenon which only occurs in very severe and usually fatal cases.

The pulmonic form of the disease, which was so prominent in the epidemic known as "black death," is extremely fatal and is known to occur at the present day. Dr Calmette, a French physician, who was sent by his government to study the recent outbreak in the city of Oporto, Portugal, reports that the pulmonary form of the disease was observed at that place as well as the usual or bubonic form, and that in pulmonary plague there are no buboes, but the cases are marked at the outset by a profound depression of the vital powers, by violent vomiting, cadaveric paleness, a rapidly failing pulse, and death within a few hours.

In the fifteenth century plague was again rampant in various parts of Europe, and London suffered severely from the prevailing epidemic in 1400, 1406, 1428, 1472, and 1499. In southern Europe the disease prevailed extensively during the first quarter of the century, and in Germany it was especially severe in 1438–'39. Italy, France, and Spain were again ravaged by the pestilence in 1448 to 1450, apparently as a result of a fresh importation from Asia. In 1466 over 40,000 persons died from plague in the city of Paris. These frequent epidemics and the greater care with which they were studied resulted, about the end of the century, in differentiating bubonic plague from typhus fever, with which it was no doubt frequently associated and which was an important but unrecognized factor in the mortality

statistics of the epidemics which occurred during this and previous centuries. Typhoid fever is another disease which no doubt contributed largely to the general mortality, but which was not recognized as a distinct and specific infectious malady until the first quarter of the present century. We now know that this disease is endemic in all parts of Europe and America, and that under certain circumstances it may prevail as a fatal epidemic. While modern methods of diagnosis have enabled us to recognize typhoid fever, typhus fever, relapsing fever, and bubonic plague as distinct diseases, it must be remembered that up to the end of the fifteenth century no such differentiation had been made, and the term "pest" was applied to any fatal malady which prevailed as an epidemic, and no doubt included in some instances smallpox, which prior to the discovery of Jenner contributed largely to the general mortality of the population of Europe.

Bubonic plague continued to prevail in Europe in the sixteenth century, and we have authentic accounts of a devastating pestilence in China during this century, which was probably due to this disease. The disease prevailed in London in 1563–'64, and for a time the mortality exceeded 1,000 per week; later it prevailed in Edinburgh (1568–'74) and in other parts of the British Islands. On the continent the greatest mortality occurred at Moscow in 1570. Over 200,000 people are said to have succumbed to the epidemic in this city and its environs. The disease prevailed in different parts of France during the century, and in 1572 caused a mortality of 50,000 in the city of Lyons. A little later than this (1575) Europe again suffered from a widespread epidemic, which appears to have been started by the introduction of cases from Constantinople to seaports in Italy and by extension from the same city through Austria and Germany. The city of Venice is said to have lost 70,000 of its inhabitants during this epidemic, and in Germany the city of Breslau suffered a most destructive epidemic.

Bubonic plague still prevailed in various parts of Europe at the end of the sixteenth century, and early in the seventeenth century (1603) an epidemic occurred in London which caused the death of 38,000 of the inhabitants. It continued to prevail in this city and in various parts of England, and six years later caused a mortality of 11,785 in the city of London. At the same time it prevailed to some extent in Holland and in Germany. During the year 1603 a most disastrous epidemic occurred in Egypt which is said to have caused a mortality

of at least a million. After an interval of 10 or 15 years, during which there was a marked diminution in the number of cases and the extent of its distribution in European countries, it again obtained wide prevalence during the year 1620 and subsequently, especially in Germany, Holland, and England. The epidemic in the city of London in 1625 caused a mortality of more than 35,000. In 1630 a severe epidemic occurred in Milan, and in 1636 London again suffered a mortality of over 10,000, while the disease continued to claim numerous victims in other parts of England and on the continent. Later in the century (1656) some of the Italian cities suffered devastating epidemics. The mortality in the city of Naples was in the neighborhood of 300,000, in Genoa 60,000, in Rome 14,000. The smaller mortality in the last-named city has been ascribed to the sanitary measures instituted by Cardinal Gastaldi. Up to his time prayers, processionals, the firing of cannons, etc., had been the chief reliance for the arrest of pestilence, with what success is shown by the brief historical review thus far presented. But this enlightened prelate inaugurated a method of combating the plague and other infectious maladies which, with increasing knowledge and experience in the use of scientific preventive measures, has given us the mastery of these pestilential diseases, and has been the principal factor in the extinction of bubonic plague from the civilized countries of Europe.

But it was long after the time of Cardinal Gastaldi before sanitary science was established upon a scientific basis and had acquired the confidence of the educated classes. Indeed, the golden age of preventive medicine has but recently had its dawn, and sanitarians at the present day often encounter great difficulty in convincing legislators and the public generally of the importance of the measures which have been proved to be adequate, when properly carried out, for the prevention of this and other infectious maladies.

We have now arrived in our historical review at the period of the "great plague of London." For some years this city had been almost if not entirely free from the scourge, but in the spring of 1665 it again appeared and within a few months caused a mortality of 68,596 in a population estimated at 460,000. This, however, does not fairly represent the percentage of mortality among those exposed, for a large proportion of the population fled from the city to escape infection.

Upon the continent the disease prevailed extensively, especially in Austria, Hungary, and Germany. The epidemic in Vienna in 1679 caused a mortality of 76,000. In 1681 the city of Prague lost 83,000

of its inhabitants. But during the last quarter of this century the disease disappeared from some of the principal countries of Europe. According to Hirsch it disappeared from England in 1679, from France in 1668, from Holland about the same time, from Germany in 1683, and from Spain in 1681. In Italy it continued to prevail to some extent until the end of the century.

At the beginning of the eighteenth century the bubonic plague prevailed in Constantinople and at various points along the Danube; from here it extended in 1704 to Poland, and soon after to Silesia, Lithuania, Germany, and the Scandinavian countries. The mortality in Stockholm was about 40,000. The disease also extended westward from Constantinople through Austria and Bohemia.

In 1720 Marseilles suffered a severe epidemic, probably as a result of the introduction of cases on a ship from Leghorn. The mortality was estimated as being between 40,000 and 60,000. From Marseilles as a center it spread through the province of Provence, but did not invade other parts of France. In 1743 a severe outbreak, undoubtedly due to importation, occurred on the island of Sicily. A destructive but brief epidemic, which is estimated to have caused a mortality of 300,000, occurred during the years 1770 and 1771 in Moldavia, Wallachia, Transylvania, Hungary, and Poland. At the same time the disease prevailed in Russia, and in 1771 caused the death of about one-fourth of the population of the city of Moscow.

It would be tedious if I should attempt to give a full account of all the minor epidemics during this and preceding centuries, and I must now briefly review the history of the disease during the nineteenth century, which happily has witnessed its complete extinction in European countries. Early in the century (1802) bubonic plague appeared at Constantinople and in Armenia. It had previously prevailed in the Caucasus, from which province it extended into Russia. In 1808 to 1813 it extended from Constantinople to Odessa, to Smyrna, and to various localities in Transylvania. It also prevailed about the same time in Bosnia and Dalmatia. In 1812 to 1814 it prevailed in Egypt, and, as usual, was conveyed from there to European countries. Its last appearance in Italy was at the seaport Noja, on the eastern coast of that country, in 1815. A limited epidemic occurred in Greece in 1828 as a result of importation from Egypt. During the same year it prevailed extensively in Moldavia, Wallachia, and Bessarabia. In 1831 it again prevailed as an epidemic in Constantinople and in various parts of Roumelia, and again it appeared in Dal-

matia in 1840 and in Constantinople in 1841. Egypt, which for centuries had been the principal focus from which plague had been introduced into Europe, continued to suffer from the disease until 1845, when it disappeared from that country.

The last appearance of oriental plague in Europe, until its recent introduction into Portugal, was the outbreak on the banks of the Volga in 1878–'79. The disease had previously prevailed in a mild form in the vicinity of Astrakhan and was probably introduced from that locality. An interesting fact in connection with this epidemic is that in Astrakhan the disease was so mild that no deaths occurred, and that the earlier cases on the right bank of the Volga were of the same mild form, but that the disease there increased rapidly in severity and soon became so malignant that scarcely any of those attacked recovered. This is to some extent the history of epidemics elsewhere, and not only of plague, but of other infectious diseases, such as typhus fever, cholera, and yellow fever. In all of these diseases the outset of an epidemic may be characterized by cases so mild in character that they are not recognized, and during the progress of the epidemic many such cases may continue to occur. These cases are evidently especially dangerous as regards the propagation of the disease, for when they are not recognized no restrictions are placed upon the infected individuals, although they may be sowing the germs broadcast.

The termination of an epidemic in the presanitary period depended to a considerable extent upon the fact that those who suffered a mild attack acquired thereby an immunity, and that when the more susceptible individuals in a community had succumbed to the prevailing epidemic, there was a necessary termination of the epidemic for want of material. This is illustrated in such cities as Havana and Rio de Janeiro, where yellow fever is an endemic disease. The natives of these cities have an immunity which probably results from their having suffered a mild attack during childhood, and the epidemic prevalence of the disease depends on the presence of "unacclimated" strangers.

Another factor which no doubt has an important bearing upon the termination of epidemics is a change in the virulence of the germ as a result of various natural agencies. Time will not permit me to discuss this subject in its scientific and practical aspects, but the general fact may be stated that all known disease germs may vary greatly in their pathogenic virulence, and that in every infectious disease

mild cases may occur, not only because of the slight susceptibility of the individual, but also because of the "attenuated" virulence of the specific germ. In the eighteenth century, the beginning of sanitary science, isolation of the sick and seaboard quarantines came to the aid of these natural agencies, and did much in the way of arresting the progress of this pestilential disease. At the present day these measures, together with disinfection by heat or chemical agents, are relied upon by sanitarians with great confidence as being entirely adequate for the exclusion of this disease or for stamping it out if it should effect a lodgment in localities where an enlightened public sentiment permits the thorough execution of these preventive measures; but when the disease prevails among an ignorant population which strenuously objects to the carrying out of these measures, the contest between the sanitary officer and the deadly germ is an unequal one, and the stamping out of an epidemic becomes a task of great magnitude, if not entirely hopeless. This is illustrated by the experience of the English in their encounter with bubonic plague in their Indian Empire.

I shall not attempt to trace the history of plague in Asia, and, indeed, reliable data for such an attempt are wanting, but we know that bubonic plague has frequently prevailed in various parts of Asia Minor, in India, and in China. According to Hirsch, the first trustworthy information of the occurrence of plague in India dates from the year 1815, when it appeared in the low country of Hindostan, where it has prevailed to a greater or less extent up to the present day.

Tropical Africa has never suffered from the plague, and in general it may be stated that a tropical climate is less favorable to its epidemic extension than a semi-tropical or temperate one. This is shown by the records relating to mortality from the disease in Alexandria, Egypt. During the epidemic period extending from 1834 to 1843, the mortality invariably fell off during the months of June, July, and August, and a recrudescence of the disease occurred in December and January, the acme of mortality being reached in March.

All authorities agree that filth, famine, and overcrowding of dwellings are potent factors in the propagation of the plague, and it is for this reason that it is to a large extent a disease of the poor, and that epidemics are especially liable to occur during times of distress from insufficient harvests or the ravages of war. The idea that the plague may originate *de novo* as a result of the causes mentioned as favorable to its propagation is not supported by satisfactory historical

evidence or by what is known of other specific infectious diseases. Whatever may have been the original home of the disease or the circumstances to which it owes its birth, there is no reason to believe that during the period covered by our historical data it has occurred in any other way than by the introduction of infected individuals or animals or articles of clothing and merchandise from infected localities.

I must now refer briefly to the history of plague during the past decade. The disease seemed to be almost a thing of the past and no longer gave any uneasiness in the countries of Europe which had formerly suffered from its ravages, when, in February, 1894, it made its appearance in the city of Canton, China, and three months later in Hongkong. The disease is known to have been epidemic in the province of Yunnan, which is about 900 miles distant from Canton, since the year 1873, but it attracted little attention until the lives of Europeans living in the city of Hongkong were threatened by the outbreak of an epidemic among the Chinese residents of that place. Many thousands of deaths occurred in Canton during the three months which elapsed after its introduction into that city before it effected a lodgment in Hongkong.

Fortunately this outbreak gave the opportunity for competent bacteriologists to make scientific investigations relating to the specific cause of this scourge of the human race and to the demonstration that it is due to a minute bacillus. This discovery was first made by the Japanese bacteriologist, Kitasato, who had received his training in the laboratory of the famous Professor Robert Koch, of Berlin. This discovery was made in the month of June, 1894, in one of the hospitals established by the English officials in Hongkong. About the same time the discovery was made, independently, by the French bacteriologist, Yersin. From this time the study of plague has been established upon a scientific basis, and very material additions have been made to our knowledge with reference to the prevention and treatment of the disease. We have learned that certain of the lower animals, including rats and mice, are very susceptible to infection, and that they play an important part in the propagation of the disease; also that the germs are found not only in the blood and in pus from suppurating buboes, but also in the discharges from the bowels of infected individuals. This being the case it can readily be seen how important a strict sanitary police is in arresting the spread of an epidemic. As in other filth diseases in which the germ is present in the

excreta of the sick, insects, and especially fleas and house flies, probably play an important part in the spread of the disease.

Dr James A. Lowson, who has written an excellent account of the epidemic in Hongkong, says: "Filth and overcrowding must be recorded as two of the most important factors. The district of Torpingshan supplied these factors in a marked degree at the beginning of the outbreak, the majority of the houses being in a most filthy condition, as owing to the uncleanly habits of the people the amount of what is generally termed rubbish accumulates in a Chinese house in a crowded city to an extent beyond the imagination of civilized people. When to a mixture of dust, old rags, ashes, broken crockery, moist surface soil, etc., is added fecal matter and the decomposing urine of animals and human beings, a terribly insanitary condition of affairs prevails."

The period of incubation in bubonic plague, *i. e.*, the time which elapses between exposure to infection and the development of the disease, is comparatively short, usually from three to six days.

From the report of Dr Lowson of cases treated in the various hospitals of Hongkong under the control of English physicians, it appears that the mortality was much greater among natives of Hongkong than among the foreign residents of that city. The mortality among Europeans (11 cases only) was 18.2 per cent; among Japanese (10 cases), 60 per cent; among Portuguese (18 cases), 66 per cent; among Chinese (2,619 cases), 93.4 per cent. To a considerable extent, no doubt, this difference in mortality was due to the unfavorable surroundings of the natives and their lack of proper nursing and medical attendance, many of them being brought to the hospital in a dying condition.

Dr Lowson pays the following tribute to the trained female nurses who assisted in nursing in the plague hospitals:

"If ever this colony had reason to congratulate itself it was when we were able to procure well trained British nurses. I think the greatest compliment that I can pay these ladies is to say that had it not been for their presence there could have been no well run epidemic hospital during last summer. Amateur nurses at the beginning of an epidemic, or indeed at any stage where there is a rush, are worse than useless, and multiply the worries of a medical officer *ad infinitum;* not only this, but all outsiders took care to give our hospitals a wide berth. When in the hospitals it was often a matter of difficulty for the medical officers employed to keep their meals on their stomachs. It would have been much harder if they had had to remain in constant attendance all the time, as our sisters had to do. Smallpox is bad, but there is something specially

awe-inspiring in plague which seems to appall the onlooker. Cholera and small-pox show external evidences which make a spectator aware of the existence of a severe disease, but to witness rows of plague patients dying off in a hospital has, I am sure, a much more depressing effect on bystanders than the two diseases I have mentioned."

Three attendants in the various hospitals contracted the disease and died, but that attendants in a well conducted hospital run but little danger of infection is shown by the following statement by Dr Lowson: "It is to me a source of keen gratification that none of the attendants in the government hospitals were attacked." In this respect bubonic plague resembles cholera, typhoid fever, and yellow fever. In none of these diseases are the attendants upon the sick apt to contract the disease when proper precautions are taken as regards cleanliness of the patient and disinfection of excreta.

The plague bacillus is very easily destroyed by disinfectants. Dr Lowson reports that a one-per-cent solution of carbolic acid kills the bacilli within an hour, and a two-per-cent solution almost immediately. Quicklime was almost as prompt in its action. Exposure to fresh air for three or four days usually destroyed the vitality of the bacillus, and exposure to direct sunlight destroyed it in three or four hours.

Kitasato and Yersin both arrived at the conclusion that the disease may be contracted by inoculation through a wound or abrasion, by way of the respiratory tract when the bacillus is present in dust carried by the inspired air, or by way of the stomach when food or drink taken contains the bacillus. Experiments on rats and other animals show that they become infected when cultures of the plague bacillus are deposited upon the mucous membrane of the nose.

The Japanese physician, Aoyoma, who was associated with Kitasato, and who contracted the disease, but recovered, is of the opinion that in a great majority of the cases, and perhaps in all, infection occurs through an external wound. He calls attention to the fact that physicians and nurses in attendance upon cases of the disease rarely become infected, and states that during the epidemic of 1894 in Hongkong only three Japanese and one Chinese physician became infected, while all the nurses escaped; also to the fact that of 300 English soldiers who volunteered to clean and disinfect the Chinese pest-houses during the prevalence of the epidemic, only ten contracted the disease. The greater liability of the lower class of natives to contract the disease he ascribes not only to the insanitary surroundings in which

they live, but also to the fact that they seldom wear shoes and stockings, and thus are very liable to infection through insignificant wounds, scratches, or abrasions, both of the feet and hands. In this connection it is well to call attention to the fact that in former epidemics physicians have suffered severely, and that whatever immunity they enjoy is due to the observance of sanitary precautions, the importance of which has become apparent as we have acquired a more exact knowledge of the etiology of the disease. It is said that more than half the French physicians in Cairo perished from plague during the Egyptian epidemic in 1843, and in the Russian epidemic, having its principal focus in the town of Vettianka, in the year 1879, three physicians and many of the nurses who cared for the sick succumbed to the plague.

The appearance of plague in Bombay in 1896 is usually ascribed to importation from Hongkong. The first cases occurred in the month of August, but it was not until December that the death rate became alarming, the mortality for the last week in this month being 1,384. In January the mortality was nearly 5,000 and in February 4,600, although by this time the population of the city had been diminished by about one-half by the flight of its inhabitants. In March there was a notable reduction in the number of deaths, and this continued during April and May, and in August the disease had almost disappeared; but early in 1898 there was a recrudescence of the epidemic, and in November of that year the total mortality had reached 26,423. The disease extended throughout the Bombay Presidency, following, as a rule, the lines of railway. In this way it reached Surat and Baroda, on the northern line; Poona, Karad, and Miraj, on the southern; Calcutta and Nasik, on the eastern, and Sholapur and Hyderabad, on the southeastern. The total mortality in the Presidency of Bombay up to the latest reports (November 11, 1899) has been 164,083. At the same date bubonic plague was prevalent to a greater or less extent in China, Egypt, Japan, Formosa, Madagascar, the Straits Settlements, Persia, Portugal, the Argentine Republic, and Brazil. Quite recently cases have occurred at Honolulu, in the Hawaiian Islands, and at Manila, in the Philippines. The disease has also been introduced into New Caledonia, and from there to Sydney, Australia. What the future history of this disease may be in countries where, owing to a dense and ignorant population, modern sanitary measures are difficult to enforce, no one can say; but, as stated at the outset of this paper, sanitarians have little apprehension with

reference to its extension in America and the more enlightened countries of Europe.

I have already referred to the fact that rats are susceptible to infection by the plague bacillus. During the epidemic prevalence of the disease these animals die in large numbers, and there is good reason to believe that they play an important part in the propagation of the malady. It has been suggested that infection may be carried from rats to man through the agency of fleas, which swarm upon these rodents and desert them when they die. Plague bacilli have been found in the intestinal contents of the flea, and it is said that when an infected rat is freed from these parasites it cannot communicate the disease by association with healthy rats. There is nothing improbable in the view that the flea may act as an intermediate host for the plague bacillus and play an important rôle in the propagation of the disease under consideration. In this connection it may be well to recall the fact that the mosquito has been demonstrated to serve as an intermediate host for the malarial parasite, and to play an important part in the communication of malarial diseases to man; also that the tick is the intermediate host of the parasite which is the cause of an infectious disease of cattle known as Texas fever.

In a recent paper Professor Galli-Valerio, of the University of Lawsanne, combats the idea that the flea which is parasitic upon the rat can be instrumental in conveying the infection of bubonic plague to man. In experiments made upon himself he was unable to obtain any evidence that this flea (*Typhlopsylla musculi*) will remain upon the body of a man unless under compulsion, or that it will puncture the skin of a man. He admits, however, the possibility that plague might be transmitted from man to man by the well-known domestic flea (*Pulex irritans*).

During the past two or three years a number of prominent bacteriologists have been engaged in researches relating to the prevention and cure of bubonic plague by means of an antitoxic serum obtained by the same method and in accordance with the same fundamental scientific principle as in the case of the antitoxic serum which is now so successfully employed in the treatment of diphtheria. The experiments thus far made have apparently been attended with a considerable degree of success. Professor Calmette reports that the serum of Yersin prepared at the Pasteur Institute, in Paris, proved to be curative in a considerable proportion of the cases treated during the recent outbreak at Oporto, and that protective inoculations conferred

a temporary immunity, which, however, did not last longer than twenty days. The mortality in cases not treated by Yersin's serum was 70 per cent; in those treated with it, 13 per cent.

The inoculations made by Haffkine in Bombay appear to have been quite successful. In his first experiment 8,142 persons were inoculated. Of these 18 subsequently contracted the disease and two died. Among 4,926 persons inoculated a single time at Dharwar, 45 were subsequently attacked and 15 died, while among 3,387 persons in whom a second inoculation was made only two were attacked. Haffkine uses in his inoculations a sterilized culture of the plague bacillus. The inoculation is followed by slight fever and enlargement of the nearest lymphatic glands. All symptoms disappear at the end of two or three days.

The figures just given are from the report of Mr E. L. Cappel to the Plague Commission. In this report Mr Cappel says:

> "If this experiment had failed the results, judged by the actual mortality among the non-inoculated, would have been appalling. All sanitary measures in the shape of disinfection, unroofing of houses, and segregation were applied concurrently with inoculation, as the government is already aware; but the rate of mortality among those who held back from the inoculation rose at one time to a height which I believe has never been approached elsewhere, standing in the third week in September at the figure of 657 per thousand per week."

Another form of treatment used in Bombay hospitals is the "Heil-serum," also prepared under the patronage of the government, at the Parel government house, by the assistants of Professor Lustig, whose name it bears. The serum has not been extensively employed in India because of its scarcity, and also on account of the prejudices of the natives. It has, however, been used in some 500 cases, with 60 per cent recoveries and 40 per cent mortality, while the death rate in untreated natives may run as high as 80 per cent. Those who are engaged in making the serum maintain that much better results than those indicated in the above percentage can be obtained by increasing the number of healing units in the serum. In one of his articles Lustig states that he succeeded in curing completely 26 out of 30 cases of plague with his serum.

The appearance of a plague-stricken city at the present day is depicted in a graphic way by Doctor L. F. Barker, of Johns Hopkins University, who recently visited India as a member of the Medical Commission sent out under the auspices of the University. Doctor Barker says:

"Twice before Poona has been ravaged by the plague, and each succeeding epidemic, unfortunately, has been worse than the preceding. In February of the present year (1899) the chief plague authority stated that the disease had been stamped out of the city. In March and April the death rate considerably increased, and in July the disease appeared in its worst form, carrying off from 150 to 160 people a day. Normally, the city has a population of 140,000, but in five months it has dwindled to 60,000. But as the population went down, the mortality went up, and even at the time of our visit still persisted at the rate of 150 deaths a day. Such a rate of mortality in New York would mean about 10,000 deaths per day, 70,000 per week. Even in Poona enough people die in a month to populate a prosperous American city. During August there was an average of 100 hospital admissions per day and over 80 deaths.

"The excursion to Poona was most impressive. Traveling upward for hours through the Western Ghats, the country was so beautiful and the air so much cooler than at the sea-level that one could scarcely believe that he was approaching, in the plain a little lower down on the other side, the pest-stricken city of Poona. On arrival at the railway station, however, the first signs of distress were noticed. Train-loads of people were fleeing from the place. A drive through the town to the office of the chief plague authority showed how rapidly it was being deserted. Many of the streets were almost empty, shop doors and windows were closed and barricaded, plague notices were pasted on the wall, a preternatural stillness was everywhere noticeable, the few people encountered walking quietly along with heads bowed and faces sorrowful. A visit was made to some houses whence plague cases had just been reported, with the native editor of the principal Poona newspaper, this gentleman having volunteered his services as plague inspector. In a small hovel, scarcely larger than a ship's cabin, one might find a patient surrounded by several of his friends awaiting the arrival of the inspector. The chances for contact contamination were manifold.

"At the general plague hospital there were some eight hundred cases of the disease under the charge of Major Windle. He was assisted by eight European nurses and a number of native helpers. He complained that it was almost impossible to retain natives as workmen. Even washermen and grave-diggers could not be employed in sufficient numbers, owing to the fears and prejudices of the people. Cart-loads of the newly attacked were being brought into the hospital at its entrance, while a body was carried out from the wards every ten minutes to the morgue at the rear. Those who live in the West can scarcely appreciate the enormous disadvantages under which medical men fight plague in India. The people are ignorant and superstitious, the rigid caste rules prevent any successful application of modern hygienic measures, and even the preventive inoculation cannot be utilized to any great extent, owing to the fact that thus far the bacilli have been grown in beef broth, and the natives will not countenance such a profanation of the sacred animal. Even in death, caste rules have to be observed, and it was found at the morgue that partitions had to be put up separating the low-caste Hindoos from those of high caste, from the Mohammedans, and from the Parsees and Christians. The floor of the morgue presented a melancholy sight. In one of the rooms no less than thirty-two bodies

lay upon the ground as closely packed as was possible without actually piling the bodies upon one another. Mohammedans are buried and high-caste Hindoos are burned, but the bodies sometimes accumulate so fast that they cannot be disposed of by the usual methods. Major Windle stated that one day, a short time before, he had burned twenty-four bodies in one heap. It is absolutely impossible in Poona to employ occidental methods in the way of segregation or disinfection. The natives prefer to die rather than submit to rules which are obnoxious to them. It is no uncommon sight to see a widow, after uttering the death wail, beating her face and breasts and throwing herself violently upon the body of her dead husband, kissing his face and lips. It is very strange that no more than do contract the disease. One left Poona and Bombay thankful that in America no such unfavorable religious and social conditions prevail."

ICE-CLIFFS ON WHITE RIVER, YUKON TERRITORY

By Martin W. Gorman

During the season of 1899 it was my good fortune to make two trips across country from the Yukon to White River, the first a winter trip with dogs and toboggans, the second a summer trip in which we had to depend largely on back-packing, as we had only one horse for a party of four. On the first trip we left Fort Selkirk (lat. 62° 46′ 42″ N., long. 137° 20′ 22″ W.), 176 miles south of Dawson, March 24, traveling in a direction 20 degrees S. of W. and crossing White River about 200 miles above the mouth three weeks later.

In the course of this trip, while traversing the headwaters of the Klotassin River (the chief eastern tributary of the White), I observed some tracts which, while composed of a fairly rich soil, were overgrown with a small growth of alders, willows, and scrub birch (*Betula glandulosa*) and a decidedly sparse and dwarfed growth of black spruce (*Picea mariana*), ranging in diameter from three to eight inches and in height from 15 to 40 feet, and the only tree found growing thereon. Many of these trees were dying, or in a very unthrifty condition, while others, already dead, showed great masses of their small persistent cones still clinging to the tops, and thus gave the landscape a rather weird and uncanny appearance, as there was no apparent cause for their death.

In close proximity to these tracts the same tree, fully 80 feet high, and its near congener, the white spruce (*Picea canadensis*), more than 100 feet high, could be found growing on a much less fertile soil. In

trying to account for this anomaly, I, at the time, attributed it to the possibility of these tracts being the beds of ancient lakes; that the water of the spring freshets lay too long thereon, and that the cold from this source caused the dwarfing of the trees.

On the second trip we left Fort Selkirk July 22, reaching White River at a point a few miles south of our former crossing on August 6. In again traversing the same region I found that the vegetation on these tracts gave no evidence of any protracted submergence during the spring freshets; that the amount of water resulting from the melting snows in spring was much less than expected, and that the depauperate condition of the trees must be attributed to some other cause.

While camped on the river bank awaiting the return of my companions, I frequently heard large masses of earth and trees tumble into the river with a loud report from the face of a bluff on the east bank about one and a half miles below camp, and finally decided to go down and examine it, as the water was then low, and there was no apparent cause for any serious or continuous undermining of the river banks at that season.

This bluff was situated about 210 miles above the mouth, and proved to be a truncated hill with strong evidence that a slough from the river at one time divided it from the mainland, and that it then formed an island. On climbing to a spot on the face of the bluff, from which it could be more closely examined, I found that the supposed hill was simply a mass of ice about 60 feet high, surmounted by a capping of earth from five to seven feet deep, composed of a superimposed layer of sand and gravel either alluvial or morainal, and above this a deposit of decomposed vegetable matter about ten or twelve inches in depth, the whole overgrown by a stunted growth of trees such as I had previously seen on the supposed old lake beds.

About two weeks later, while drifting down the main stream on a raft, at a point on the east bank about 25 miles below the bluff above mentioned, I observed another of these ice-masses, this time situated in low ground and only 20 feet high, and surmounted by some six feet of earth, and, as before, covered with a stunted growth of trees. Three days later, on August 31, at a point on the west bank about 16 miles above the confluence of the main stream with the west branch (Katrina River of recent maps)—in other words, 113 miles above the mouth of the river—I observed the third of these ice-cliffs, this one being about 30 feet in depth from the present water-level to the top and sur-

mounted by about six feet of earth, with the usual superimposed layer of decomposed vegetable matter. On seeing the first two I at once recalled to mind an article by Lieut. J. C. Cantwell on "Ice-cliffs on the Kowak River."* The diminutive magnitude, almost pigmy in size, of these cliffs as compared with those seen on the Kowak by Lieut. Cantwell, may to a great extent be accounted for by the difference in latitude and amount of winter precipitation. Lieut. Cantwell does not state the depth of the winter's snow, but says "the banks of the stream in the region where the ice-cliffs are found are not all filled with ice," which is sufficiently suggestive. The greatest depth of snow in midwinter on the White River (except about the extreme headwaters near the Coast Range) is only about four and one-half feet, and it is dry and powdery, disappearing rapidly in spring without causing nearly as much of a freshet as I had anticipated. No loose ice whatever remains along the banks of the river through the summer, though it is to be found in the V-shaped gulches and valleys of the smaller affluents.

It was only on seeing the third cliff that the true nature of these ice-masses suggested itself to me, *viz.*, that they are the remnants of buried glaciers through which the stream has recently cut its way. There is ample evidence of recent and vigorous erosion, the water at present being so surcharged with a mixture of fine blue clay and granitic sand that a bucket of it on being allowed to settle will reveal a deposit of about one-fourth inch in depth, while small boulders and pebbles are being forced along over the bars and riffles by all the vigor of a seven to ten-mile current. On the other hand, the evidence of glacial action, at least of recent date, is lacking, so far as my observation went, though a more thorough examination, particularly among the harder rocks of the divides and crest lines, will, I think, reveal former activity. Such glacial action as did occur will probably prove to be due to local glaciers, as there is no evidence of either a large continental ice-sheet or of the amount of precipitation necessary for its formation.

The third cliff occupied the bottom of a small valley, and its appearance, together with the stunted growth of black spruce on its surface, so strongly resembled the tracts I had seen on the headwaters of the Klotassin in March, and then supposed were old lake beds, that I was at once forced to the conviction that the cause was the same in

*National Geographic Magazine, vol. VII, p. 345, Oct., 1896.

both cases, and that the latter as well as the former are underlain by masses of ice.

When the face of the cliffs, as in the first two instances, was toward the south, the powerful action of the sun's rays during the long subarctic summer days of the region had made its effects very apparent on the upper portion of the cliffs, both of which were to a great extent hidden by talus, slopes of earth, muck, uprooted trees, and brush, this latter a factor that made their detection from midstream much less likely. The face of the third cliff, being toward the north, was perpendicular, its base washed by the stream, and was without any talus whatever. All of them under present conditions are undoubtedly undergoing a process of rapid diminution.

I think it more than likely that both the Kuskokwim and Tanana rivers will, on examination, reveal ice-masses of a similar nature to those on the Kowak and White, though no mention of such being observed is made either by Hallock * or Allen.† When such are found, if any, they may enable the geologist to determine the real nature and cause of these bodies of ice, if the above theory of their being the remnants of buried glaciers is not accepted.

The main stream of White River and the Katrina or west branch both take their rise among the glaciers of a range of snow peaks lying east of and approximately parallel to the Coast Range, in Alaska, not far from the sources of the Tanana and Copper rivers, while the east branch (Klotassin River of the maps) is non-glacial and has its source in a number of small affluents in Yukon Territory. The water of the Klotassin is as clear as crystal, whereas the water of the main stream and the Katrina is almost milky white, thus giving rise to the name White River (first applied by Robert Campbell, of the Hudson's Bay Company, in 1850, and called Milk River by the early miners). Ladue Creek, on the other hand, which enters from the west some 36 miles above the mouth and takes its rise in the tundra and sphagnous marshes near the headwaters of Sixtymile River, is of a decided brown, being about the color of fairly strong tea. The main river is rather more than 300 miles long, following the course of the stream, and has no rapids worthy of the name, but there are a cañon and rapids five miles long on the west branch about 60 miles above the confluence. The country is dotted with lakes and lakelets in the vicinity

* National Geographic Magazine, vol. IX, p. 85: "Two hundred miles up the Kuskokwim," Charles Hallock, March, 1898.

† Reconnaissance in Alaska, Lieut. H. T. Allen. Washington, 1887.

of the confluence of the White and Katrina, scores of them being visible from the summit of a small table-topped mountain immediately west of the mouth of the latter stream. There is no reliable map of the White and its tributaries in existence, since nearly all of them show Ladue Creek as about equal, if not superior, to the Katrina in size, whereas it discharges less than one-tenth as much water as the latter, which almost equals the main stream in size. The Nisling River of the maps I was unable to find unless it is represented by a comparatively small creek which does occur in the vicinity indicated.

There is considerable evidence of recent volcanic activity in the valley of White River, and this evidence is much more pronounced in the region between the White and Yukon. It is in this section that we must look for the mountain or caldera responsible for the immense deposit of volcanic pumiceous ash which forms so noticeable a feature of the banks of the Yukon from Caribou crossing to Dawson, a distance of 520 miles by the course of the stream. There is not a trace of it to be seen along the banks of the White except near the mouth, while it is very noticeable along the banks of some of the creeks between the latter and the Yukon. This would preclude the possibility of this deposit being caused by an outburst from Mt. Wrangell, as suggested by Dawson,* as an outburst from any mountain in the vicinity of Wrangell would undoubtedly deposit even a greater layer of the ash on the White than it would on the Yukon.

Another theory regarding this deposit,† *viz.*, that it is not of recent date and that deposition took place in water while the upper Yukon was yet a great inland lake and before the present river channel had been cut, is also untenable, as the ash in many places may be found overlying old drift-piles of perfectly sound wood, notably at the mouth of Stewart River and again above the mouth of the Pelly. It therefore still remains for some energetic member of the next Dominion Geological Survey party that traverses this region to locate the caldera from which such an extensive and remarkable deposit has been ejected. The solution of the question is certainly worthy of an effort.

* Report on an exploration of the Yukon district, N. W. T., 1887, George M. Dawson, p. 45. B. Dawson Bros., 1888.

† Alaska and the Klondike, Angelo Heilprin. D. Appleton & Co., 1899.

A HUNTING TRIP TO NORTHERN GREENLAND

By Fullerton Merrill

On July 21, 1899, the steam sealer *Diana* left Sydney, Cape Breton Island, bound for northwestern Greenland. She was commanded by Mr H. L. Bridgman, secretary of the Peary Arctic Club, and was to take supplies for Lieutenant Peary and his party, and to bring back news of what they had accomplished during the previous year. Besides the Peary relief expedition, there was on board a North Greenland hunting party, eight in number, led by Mr Russell W. Porter, of Boston, of which company I was a member.

The *Diana* steamed through the Gulf of St Lawrence and Belle Isle Strait, and on July 24 entered Domino Run, from whence her course was laid for Disko Island. That same night we encountered an ice-pack of small floes, and it was fifteen hours before we were again in open water. On July 30 we touched at Godhavn, next at Upernivik, and soon afterward we reached Melville Bay. We expected to have a tussle with the Melville Bay pack, but found, much to our surprise, that it was nowhere to be seen, having probably been blown to the westward, so that we crossed the bay in twenty-two hours, thus beating all previous records. At the Eskimo settlement at Cape York we met the first of the Whale Sound natives—the Arctic Highlanders. At Dalrymple Island we killed many eider ducks, and at Saunders Island obtained three Eskimo guides for the hunting party. On August 4 the *Diana* dropped anchor between Hakluyt and Northumberland Islands, in the mouth of Inglefield Gulf, this being the region chosen for walrus hunting. With tents and equipments we of the hunting party landed on Northumberland, in a little cove almost surrounded by mighty rock masses surmounted by a crowning ice-cap. The ship steamed away to the north.

As we had not learned the art of harpooning—a walrus if shot before being harpooned usually sinks at once—the beginning of the work was left to the natives. When a walrus was discovered in the open water, an Eskimo started off in a skin kayak, we following at a little distance in a large boat, ready to do our part with the rifle when the animal had been harpooned. After the harpooning we would make for the inflated seal-skin float, which was attached to the harpoon line, and make it fast, and then as soon as possible draw it into the

boat, and in another second would be tearing along through the water in the wake of an angry walrus. As the huge beast came to the surface the man whose turn it was to shoot would try to put an end to the animal's struggles by a well-placed bullet in the back of the neck.

It often happened that walrus would be seen on an ice-floe, sometimes from six to a dozen being on a single pan. In such cases one or even two of the natives would come into our boat and stand up in the bow while we headed directly for the walrus. Silently we would creep up until the floe was reached or even struck by us before the walrus would take to the water. Then the harpoon would flash, the sea would be alive with angry tusks, and it would look as though the destruction of the boat was inevitable; but after firing a few shots here and there at the more furious of the animals peace would again reign, with only the absurd-looking floats to tell of the tumult.

Early one morning, while we were still on the sea after a night of it, we came upon so many walrus that the natives hesitated to attack them. Everywhere could be seen herds of a dozen or more, now rising high above the water, now disappearing below its surface, and as we drew near their furious grunts and bellowings rent the air. The shore was miles away. At this point there was nothing but glacier front and steep gray cliffs, while but a single ice-pan floated between us and the land. Nearer and nearer drew the lines of battle, our white boat a conspicuous object against the green of the water, and still the walrus kept closing in about us. Suddenly a herd of six or eight rose out of the water but a few yards away and bore down upon us as we lay with our broadside turned toward them. Each man grasped his rifle, while one stood up and, imitating the grunts of the animals, called them on. Then, when but a few feet of water separated them from us, he raised his rifle and fired at the leading bull in the herd. The shot struck the animal fairly in the face, and quick as a flash the whole herd disappeared. They must have gone right under the boat, so great had been their impetus. As the early morning mists faded away the walrus became quieter, and in a short time only a few dozen of them were seen sporting among the ice-cakes in the mouth of Inglefield Gulf. Needless to say, there were several walrus heads in our boat when, after a long, hard row, we landed before the camp.

The next day the *Diana* appeared. Those on the ship had had walrus hunting as well as we, having received a message from Lieutenant Peary to the effect that he needed fresh food for his dogs.

Brave "Matt" Henson, Peary's colored companion, was also on board, having been picked up at Etah, and on the ship's deck were 10 or 15 Eskimo. For a few days we took part in the hunting, and during that time reached our farthest north, the entrance to Smith Sound, a little above 78° north and something more than one degree south of the ship's farthest north (79° 10′); then one glorious summer day we left the ship and pitched our tents on the rolling shores of Olriks Bay. We knew that there reindeer wandered over the moss-covered uplands, and we had come to hunt them.

We stayed four days at this place, hunting over the country for some 10 miles to the southeast. We got five deer, but we thought there might be better hunting farther up the fiord, so on August 15 we moved camp. Twelve hours later, after a hard fight against wind and tide, we landed beside the red-brown cliffs and black lava masses of Mt Gyrfalco.

For eight days we scoured the shore and the mountain plateau above for deer. The country was everywhere open, low ridges and occasional large stones being the only protection afforded us. The stalking was of the most arduous description; when game was seen the hunter must "drop" at once and crawl along over marshy places and sharp stones until near enough to risk a shot. The chances were that in spite of all precautions the deer would note his approach and be off like a flash. Many were the hunts and many the disappointments. We soon felt, moreover, that the deer were not nearly as numerous as we had supposed, considering the extensive area over which they wandered: nevertheless, by August 23 nine had been killed, making a total of 14. As the Greenland reindeer makes very good eating, we lived well. On one occasion one of our party while hunting alone discovered a herd of five deer and by skillful manœuvering succeeded in killing every one of them.

In the intervals between our hunts after larger game we killed birds and small animals. Specimens were obtained of almost every kind of bird known to frequent those parts of Greenland. Among these were the burgomaster gull, turnstone, black turnstone, parasitic jäger, various shore birds (including snipe), and the hawk-like gerfalcon. Eider ducks, both male and female, were seen flying in flocks, and once a flock of geese was discovered sitting on a mud flat. Little auks and guillemots were also plentiful. Arctic hares and rabbits, the latter the smaller of the two and with fur of a bluish tinge often graced our table and were considered by us excellent eating.

Almost everywhere along the Greenland coast we had caught glimpses of the Great Inland Glacier, or mighty Ice-Cap, which covers the interior of the country. From the North Water a vast stretch of the great ice-sheet had been seen, flowing over the peaks which bordered Inglefield Gulf.

On August 23 we started with dogs, sledges, and Eskimo dog drivers for a trip upon this mighty table-land of ice. Three Eskimo with their families had come over with us from Inglefield Gulf, and we had two sledges and eight dogs. In the afternoon we rode across Olriks Bay, each man shouldered his pack, the Eskimo took up the dog-traces, and we were fairly on our way.

Our route lay up a steep glacier, to the west of Half Dome Mountain. To the right Olriks Bay ended abruptly in the white mass of the Marie Glacier; opposite rose the high plateau we had scoured so often for deer, and beyond, in the dim distance, stood out the purple mountains on the north shore of Inglefield Gulf, bearing on their summits the eternal icy covering of Greenland. We descended into a valley. Soon the soft, spongy soil of the latter changed to a field of ice, and the dogs were harnessed again to the sledges. But the ice was exceedingly sharp and rough, and the poor dogs howled most piteously; before long, indeed, their wounded feet were leaving blood-spots on the snow. So we harnessed all but two—which ran away—to one sledge, and pulled the other ourselves, until, a rocky ridge appearing, we halted and camped for the night.

By the next afternoon we had skirted a river, made another passage over rough ice, and were standing, at a point some six miles inland, before the towering white wall of the Great Inland Glacier. The steep slope was many hundred feet in height, and it was something of a struggle to climb it, but it was done, and, the snow furnishing easy traveling, the dogs were once more divided between the two sledges. With sledges, snow-shoes, and *ski* we made good speed. Gradually the land behind us faded away, and the undulating surface of the ice-cap became more level; on every side stretched the snowy wastes of the Arctic continent.

Three or four reddish-brown nunataks cropped up through the snow far to the left. A low ridge of ice was ascended, and at the same time a line of pale blue mountains, probably those about Wolstenholme Sound, came into view to the southwest. A sort of snow-fog settled upon us, covering us with hoar-frost.

Here, some fifteen miles from the ice edge and at an elevation of

more than 5,000 feet above sea-level, we scooped a hollow in the snow, pitched a shelter tent over it, using sledges and snow-shoes as supports, and banked the whole with snow. Snow was melted and food cooked over a "Primus" oil stove, and soon afterward, with the midnight sun brightly shining, we lay down to rest—we just filled the little shelter—and the natives kept warm by stretching themselves out between our sleeping-bags.

The next afternoon, as we started on our return, the vast expanse of the ice-cap sparkled brilliantly. In due time the ice-edge was reached. Jumping on the sledges, all hands enjoyed a royal coast to the land-level. The part of the inland ice traversed by us had never before, I believe, been traveled over by human beings. The Eskimo told us that no natives ever went there. Early on the morning of August 26, a tired party, we broke our way in the large boat through a thin coating of ice in Olriks Bay, and later on walked into our camp on the shore. We were told by our steward that Lieutenant Peary, who had been cruising about on the *Diana*, had visited the camp during our absence.

We were picked up by the *Diana* August 28, near the lower narrows of Olriks Bay. In Baffin Bay it was discovered that our coal was giving out. Fortunately, we were soon able to obtain enough from an outcropping seam on the shore of Disko Island to carry us to Battle Harbor, Labrador. There more coal was purchased, and on September 12 we landed at Sydney, Cape Breton, after a voyage which had been most successful, and which demonstrated the possibility of a summer hunting trip to the Arctic regions.

A CANAL FROM THE ATLANTIC TO THE MEDITERRANEAN

For the past twenty years the construction of a canal across the Iberian Peninsula to connect the Atlantic Ocean with the Mediterranean Sea has been strongly advocated in France. A bill urging its construction and signed by 130 members was introduced last year into the Chamber of Deputies, and is at present being considered by the Naval Committee of the Chamber, with a prospect, says *Le Tour de Monde*, of a favorable report. The strategic importance to France of such a canal in case of war with England is apparent. England's presence at Gibraltar could no longer prevent France from uniting her Mediterranean and Atlantic squadrons.

The canal as proposed starts from Bassin d'Arcachon, on the Atlantic Ocean; thence, with a branch to Bordeaux, passes through Marmande, Agen, Castelsarrasin, Toulouse, Carcassonne, Narbonne, and finally terminates in the Etang de Sijean, on the Mediterranean Sea. The entire length of the canal will be about 280 miles. The plans that have been prepared provide for a width of 37 meters, increased at intervals to 61 meters to allow vessels to pass each other, and for a depth of eight and one-half meters, and nine meters in the locks. The highest point of the canal, about 655 feet above sea-level, it is estimated would be on the hill of Naurouse, which is the lowest point in the watershed of the Garonne and of the river flowing into the Mediterranean. To reach this elevation 22, or perhaps only 18, locks will be necessary.

According to careful estimates prepared by some of the most experienced engineers of France, the total cost would be about $160,000,000. The annual receipts, on the other hand, based at 75 cents per ton, will easily reach $13,000,000 a year. The expense of maintenance, repairs, etc., is estimated at $2,000,000 annually, and the interest at four per cent on the investment at $6,400,000, making a total annual expense of about $8,500,000 a year. There would thus be a net profit of about $4,500,000 a year. It is stated that the canal could be completed within five years, allowing one year for the preparation of the necessary plans, charts, etc., and four years for their actual construction.

By the construction of this canal the water route from Isle d'Ouessant, on the northwest coast of France, to the island of Malta, in the Mediterranean Sea, would be shortened by 1,090 miles. Vessels moving at the rate of six and one-half miles an hour could, including time lost in the locks, easily accomplish the passage in 58 hours.

DISEASES OF THE PHILIPPINES

The expedition sent out by the Johns Hopkins University to investigate the prevalent diseases in the Philippines has submitted its report to the University Medical School. Notices of the plans of the expedition have previously appeared in the NATIONAL GEOGRAPHIC MAGAZINE. (See vol. X, pp. 280, 421.) Two months, May and June, were spent in the study of disease among the natives and American troops in Manila and at Cavite. Owing to the military situation, it was found impracticable to visit other ports in the Archipelago or to penetrate into the interior of the island of Luzon.

Of the diseases affecting the natives, smallpox is the most prevalent. This

disease, the commission states, has been so common in Luzon that the natives have to a large extent lost fear of it. All evidence points to the greatest carelessness in preventing its spread during Spanish times. Isolation of the sick and disinfection of the habitations seem not to have been attempted, and vaccination, even among the Spanish garrison, had not been carried out. Under these circumstances it could be no surprise that after the American occupation the disease should appear and even become epidemic; but the prompt action of Dr Bournes, chief health officer of Manila, who caused the Spanish garrison still in Manila and the natives and Chinese within the city to be vaccinated on the appearance of the disease early last year (1899), has afforded most satisfactory results. Other diseases especially affecting the natives are: leprosy, of which there were a hundred cases in the San Lazaro Hospital, all coming from Manila and the country surrounding that city; tuberculosis, of the extent of which accurate statistics are impossible to obtain, but the facts would indicate that it is a very common disease; beriberi, well known among the natives and apparently epidemic and endemic in its nature. Skin diseases, as might be expected, are also prevalent.

Of the diseases affecting Americans, dysentery is responsible for the greatest amount of invalidation and the highest mortality. Typhoid fever, while less prevalent than dysentery, is, however, a frequent affection among Americans. Malarial fevers would seem not to be very common. Other diseases which while not prevalent affect foreigners to a considerable extent are tuberculosis, dengue, and tropical ulcers.

While outfitting at Hongkong, and later on their return to Hongkong *en route* to America, the commission improved the opportunity to study the bubonic plague, which was still prevailing at that port. Two members of the party, Dr Barker and Mr Flint, also passed three weeks in India, where the great epidemic of plague was then raging. This is a brief summary of the results achieved by the expedition. Naturally the commissioners have not yet been able to complete the scientific portion of the work. They are now making careful studies of the material relating to beriberi, dysentery, malarial and typhoid fevers, leprosy, and the bubonic plague, and later will publish their results in complete form.

GEOGRAPHIC MISCELLANEA

THE United States steamer *Nero* in its survey for a Transpacific cable recorded one sounding near Guam Island of 5,269 fathoms—the deepest sea-sounding ever recorded.

REPORTS from Valparaiso, Chile, describe a fossil of the whale species discovered on the north beach at Caldera. It is stated that the fossil measures about 32 feet and is almost perfectly preserved.

WITH the completion of the triangulation between Chatham and Sumner Straits the work of triangulation in southeastern Alaska is ended, and the necessary geodetic data for the preparation of maps have been obtained.

THE present membership of the National Geographic Society is 1,300 resident and 1,300 non-resident members. This is an increase of 1,000 since June 1, 1899, when the systematic effort to enlarge the work of the Society was begun.

THE Constantinople correspondent of the London *Times* states that, as compensation for the Bagdad railway concession to Germany, Russia has demanded of the Ottoman Empire prior railway concessions in Asia Minor north of the German line.

ANNOUNCEMENT is made of the resignation of Mr John B. Hatcher from the chair of assistant professor of geology in Princeton University, to accept the curatorship of vertebrate paleontology at the Carnegie Museum in Pittsburg, Pennsylvania.

FROM the fourth report of the International Commission on Glaciers it would appear that out of 70 glaciers measured in the Swiss Alps, 12 are advancing, while 55 are receding. In the eastern Alps the retreat of the glaciers is noticeable, though not with the same rapidity as in the period from 1870 to 1890.

THE longitude of Maricopa, Arizona, has recently been determined by a U. S. Coast and Geodetic Survey party. The initial station was El Paso, Texas. Signals were exchanged on three successive nights, after which the observers changed places and three more nights' observations were obtained, thus eliminating the effect of personal equation.

CAPT. GEORGE OWEN SQUIER, of the Signal Office, War Department, contributes to a recent number of *The Independent* a summary of the arguments in favor of a United States Pacific cable. A map accompanying the article shows the routes of the proposed United States Pacific cable, the route of the proposed English Pacific cable, and also the proposed international cable spans.

IN a recent number of the *Pathfinder* is a description of a set of five relief-maps of the continent, prepared for the Paris Exposition by E. E. Howell, the well-known relief-map expert. They are all on the same horizontal scale, one inch to 120 miles, and average five feet square. The vertical scale is 1 to 500,000, the deepest ocean depths being depressed about three-quarters of an inch.

IT is expected that the committee of judges appointed by the National Geographic Society to award the prizes of $150.00 and $75.00 offered by the Society for the best and second best essays submitted during 1899 relating to pre-Columbian discoveries and settlements of the Norsemen on the mainland of North America will reach a decision in the near future, and the announcement of the successful contestants will then be made.

WILLIAM HENRY GILDER, an Arctic explorer of the seventies and early eighties, died in February at Morristown, New Jersey. In 1878 he joined the Franklin search expedition, commanded by the late Lieutenant Frederick Schwatka, U. S. A. While serving with this expedition from 1878 to 1880 he made a sledge journey of over 3,250 miles in King William Land, probably the longest sledge journey ever made in the Arctic regions. He has written the narrative of the expedition in "Schwatka's Search."

IN *McClure's Magazine* for February is an interesting article by Mr Walter Wellman, entitled "The Race for the North Pole," a narration of his Arctic ex-

plorations during 1898–'99. A detailed account of the geographic results of the expedition was given by Mr Wellman in the NATIONAL GEOGRAPHIC MAGAZINE for December. The same number of *McClure's* contains an article by Cleveland Moffett, "The Inside of the Earth," giving Professor Milne's observations and conclusions as to the interior of our planet.

"THE Bubonic Plague" is the title of a report recently submitted to the Secretary of the Treasury by Walter Wyman, Surgeon-General Marine Hospital Service, and issued by the department in pamphlet form. This valuable brochure is a revision of a paper prepared by Dr Wyman and published in the annual report for 1897. The many facts that have become known within the past few years with regard to the epidemic have been incorporated into the revision, with the result that the bulletin embodies in available form the latest information which may be of value to quarantine officers, health officers, and all interested in the study of the disease.

REPORTS from the three field parties of the U. S. Coast and Geodetic Survey at work on the south coast of Puerto Rico state that satisfactory progress is being made, and that triangulation, topography, and signal-building are going on simultaneously. Signals are located to within a few miles of Guanica, and the topography is finished to Guayanilla Bay. A large lagoon, to which little attention has heretofore been given, though a prominent feature on the coast, has been surveyed near Point Cuchara. The entire country west of Ponce and as far as Cabo Rojo is covered with a thick growth of brush and trees, which requires lines to be cut at every station, thus considerably retarding the work.

THE following is the present condition of railway construction in the Chinese Empire: Lines constructed, 365 miles; lines in process of construction, 2,615 miles; lines for which concessions have been granted, 4,125 miles. Of this total of 7,105 miles constructed, in process of construction, and conceded, 495 miles are under German control, 810 miles under American, 1,380 miles under English, 805 miles under Belgian, 670 miles under Chinese, 490 miles under French, 690 miles under Anglo-German, 1,765 miles under Russo-Chinese. To this total of 7,105 miles must be added 1,970 miles of railroad proposed and 2,885 miles of railroad for which surveys have been made but no concessions granted.

THE following report is interesting as the latest rumor concerning Andrée: "A letter received in London from Bishop Newnham, dated October 1, Fort Churchill, Hudson Bay, says: 'Two Eskimo came here this summer, traveling from the far north, to tell that two white men had come down from the sky in a balloon, the remains of which they had seen, and had been murdered by some Eskimo there. I believe this is authentic, but have not had time to inquire. Sad, if this be the last of poor Andrée and his companion.'" The fact that a letter from Bishop Newnham dated September 8, 1899, has been received in Toronto, wherein no mention is made of the supposed murder of Andrée, discredits this latest report from London.

A very instructive article on the geography of Abyssinia and the manners and customs of its inhabitants is the main feature of the *Geographical Journal* for February. The author, Herbert Weld Blundell, in March, 1898, accom-

panied the first English diplomatic representative to the capital of Abyssinia, Adis Abeba. Later, in November of the same year, he organized a party of several naturalists and passed the next six months in journeying up and down Abyssinia, finally reaching Khartum June 1, 1899. The party collected, in addition to eighteen different kinds of antelopes, 10 elephants and two lions, 520 specimens of birds, representing 299 species, of which 11 are new. The whole collection has been presented to the British Museum.

As a result of the South African war, the supply and, in consequence, the price of coal in Italy have been seriously affected. This is due partly to the increase of price in England and partly to the fact that the means of transport are becoming insufficient, inasmuch as the English government has hired a large number of transports belonging to companies and to private individuals. From an article which appeared in *L'Italie*, Rome, and a translation of which Ambassador Draper has transmitted to the State Department, it appears that in January the price of coal reached $9.65 per ton in Genoa and $11.58 in Milan. Owing to the scarcity, it was feared that many industrial establishments would be obliged to shut down and thousands of workmen thrown out of work.

PRELIMINARY work is well under way on the railway from Tsing-chau *via* Wei hsien to Isi nan fu, the provincial metropolis of Shantung, with a branch line to Po-shan, the concession for which was granted to a German company by the Chancellor of the Chinese Empire in June, 1899. The first delivery of tires, sleepers, rails, and small iron tools was shipped during December, 1899, and the foundation work for a double track is already provided for. The company has pledged itself to complete the road within five years and the extension within three years. By the construction of these 280 miles of railway, the great coal districts in the north of the province of Shantung will be brought into practical communication with the important districts between Tsing-chau and Isi nan fu and with Kiao-chau.

THE series of articles descriptive of the different forest reserves of the United States that were embodied for the Division of Forest Reserves in the Nineteenth Annual Report of the U. S. Geological Survey have recently been published as separate brochures. The series, which were prepared under the general direction of Henry Gannett, Chief of the Division of Geography and Forestry, include: *The Forests of the United States*, by Henry Gannett; *The Black Hills Forest Reserve*, by Henry S. Graves; *The Eastern Part of the Washington Forest Reserve*, by Martin W. Gorman; *The Washington Forest Reserve*, by H. B. Ayres; *The Teton and Yellowstone Park Forest Reserves*, by T. S. Brandegee; *The Priest River Forest Reserve* and *The Bitter Root Forest Reserve*, by John B. Leiberg; and *The Big Horn Forest Reserve*, by F. E. Town. Each paper is handsomely illustrated and accompanied by maps showing wooded areas, distribution of timber species, burned and restocked areas, and other practical facts. The series may be obtained by applying directly to the U. S. Geological Survey, Washington, D. C.

MATERIAL for the revision of the coast charts of New Jersey has reached the U. S. Coast and Geodetic Survey Office. In order to keep these maps up to date at a comparatively small expense, a party was put into the field during the latter half of 1899. Sufficient data were collected in this short time to prac-

tically revise the entire edition of coast charts, making them now about equal in value to those which would have resulted from a new survey. South of Bay Head the material changes are not great; but north of this point, where the details are too intricate for the methods pursued, a plane-table survey is recommended for areas beyond the local maps. Many changes were noticed in the inlets, and they take place so rapidly that a good channel one year may become a mud flat, bare at low tide, the next. These conditions are particularly noticeable at Absecon and Egg Harbor inlets. Where regular lines of steamers traverse the waters just inside the entrance, the steamboat companies find it necessary to locate the channel after nearly every heavy storm. The bars at the mouths of the inlets are all very shoal, few having more than three or four feet of water at low tide.

At the Sixth International Geographical Congress in 1895 the Geographical Society of Finland exhibited a number of charts and maps planned to represent the country and general condition of the people, many of the charts having been especially prepared for the occasion. Encouraged by the favorable reception accorded the maps, the society decided to add to the series and to publish the whole as an atlas of Finland. This atlas, which has recently been completed, contains a series of 32 large maps, from which an excellent comprehension of the present physical, economic, and social conditions of Finland may be obtained. The following charts are especially valuable: A series of six meteorological charts showing the amount of rainfall and snowfall a year, the average temperature, the direction of winds, etc.; a series of five charts showing the proportion of rural and city population, the population by professions, whether of native or foreign origin, etc., and charts giving statistics of farm products, of metals, of exports and imports, of telegraphs and telephones, railways, etc. Perhaps the most striking chart is that which shows that more than 70 per cent of the population is not represented in the Diet, the National Assembly.

A recent number of *Petermann's Mitteilungen* contains an interesting article, which by means of a two-colored map shows very clearly the proportions of the agricultural and industrial population of the German Empire. Green, which represents the agricultural sections, is the prevailing color in all parts of the empire except in Saxony and along the basin of the Rhine, where red, representing the industrial sections, predominates; in other words, the eastern part of the empire is agricultural, while a considerable part of the western section is industrial and commercial in its interests. As a consequence of the insufficient means of communication between the two sections, the articles manufactured in the east find abroad a more accessible market than in the western section; but the agricultural interests of the west, being handicapped by lack of outlet to the rest of the empire on the east and prohibited by excessive foreign duties from sending their produce to Russia and Austria, are in danger of being destroyed; hence the scheme for a canal through the center of Germany, which is at present before the Reichstag and which has been personally advocated by the Emperor. The map shows that, while German commerce has developed within the last few years to such an extent as to arouse the anxiety of England, it is yet far from equaling the agricultural interests of the empire.

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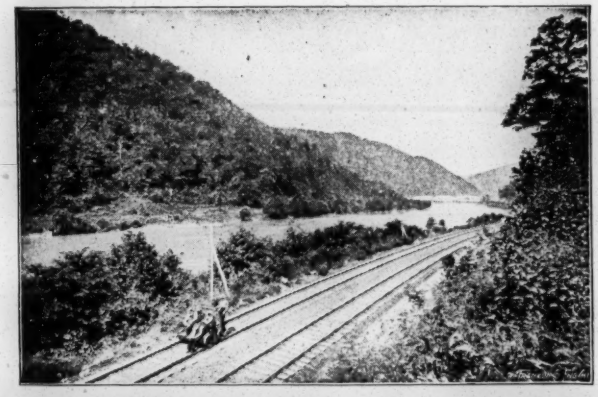

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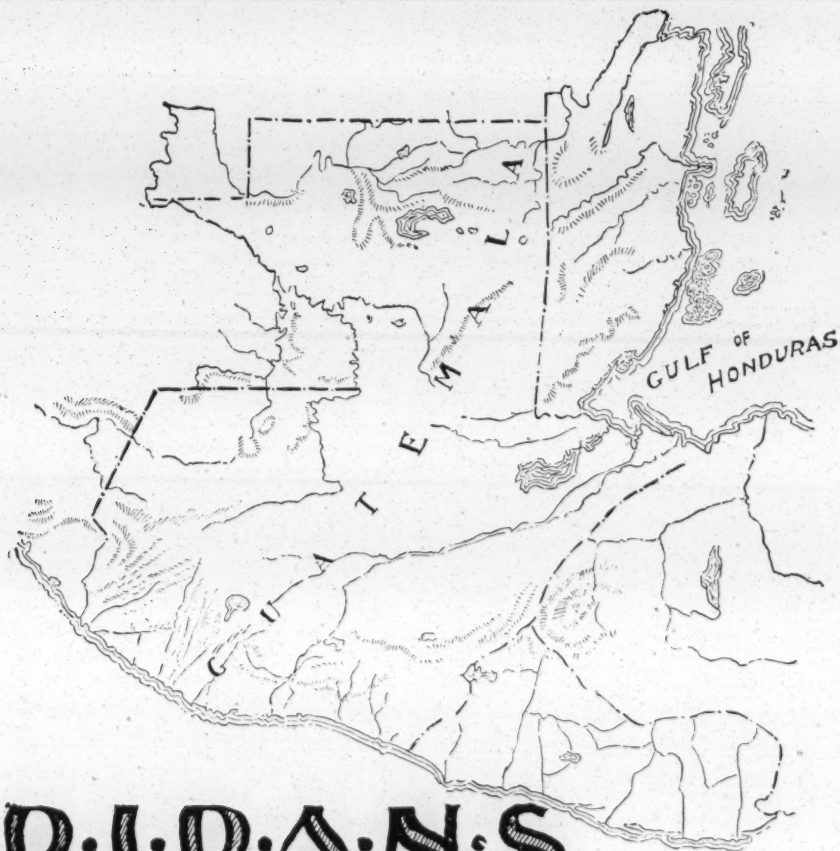

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